Midterm Exam

Wednesday 26 October 2011

1. For each statement below, fill in the blank with the *best* term from the following list. Some terms might be used more than once; some might not be used at all.

   • algorithm • ASCII • bit • Boolean • byte • hexadecimal • pixel • pseudo-code • unicode

   (a) _____ is a notation for algorithms that is more precise than descriptive English, and easier to learn than a programming language.

   (b) A(n) _____ is a tiny one-color element of a digital image.

   (c) _____ is a numbering system that is useful in computing because its base is a power of two.

   (d) _____ logic includes a set of operations on values that can be either true or false.

2. Write down the decimal (base 10) equivalents for the following 6-bit signed (two's complement) binary numbers. (That means the answers might be negative!)

   `0 0 1 1 1 1` = _____ `0 0 1 1 0 0` = _____

   `0 1 1 0 1 1` = _____ `1 0 0 0 1 0` = _____

   `1 0 0 1 0 1` = _____ `1 1 1 1 1 1` = _____

3. Add the following pairs of 6-bit signed (two's complement) binary numbers. Your answers must be in binary, but you may wish to check your work by converting to decimal. Remember, values can be negative!

```
  1 0 1 0 1 0        0 1 1 0 0 1        0 0 1 0 1 0
+ 0 1 0 0 1 1      + 1 1 0 1 0 1      + 1 1 1 0 1 0
--------------     --------------     --------------
```

4. Complete the following truth table. Add any extra columns you might need to compute intermediate results.

A	B	C	A or (B and C)	B or (A and C)

5. A digital image uses 6-bit color – two bits for each primary color (red, green, blue). What is the maximum number of colors possible? _____

6. Suppose you want to design a variable-width encoding for just the six letters `E`, `I`, `L`, `M`, `P`, and `S`. Draw a tree to represent your encoding, so that `I` and `S` use just two bits each, and the remaining letters use three bits each.

   Use your encoding to convert the following words to bits:

   (a) `SIMPLE` _____

   (b) `MISSILE` _____

   (c) `MISSISSIPPI` _____

7. Which of the following statements about *arrays* are true? Circle all that apply.

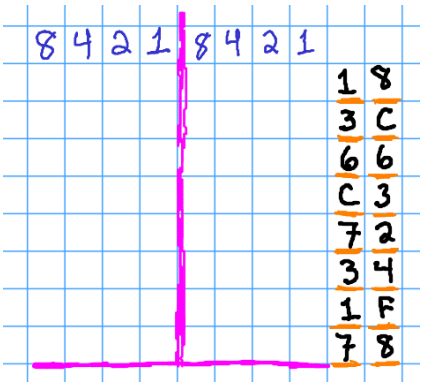
   (a) An array is a variety of pseudo-code instructions that mean the same thing.

   (b) Arrays are a way to group many pieces of data using the same variable name.

   (c) An array uses a numbers to represent distinct locations.

   (d) An array is a type of output statement.

8. Use the following 8×8 grid to decode the hexadecimal image notation, using 1 bit per pixel.



9. What is the output of the following algorithm? Remember to indicate clearly what is *output* and what is scratch work.

```
1. Set N to 0
2. Set K to 1
3. If K > 5 then output N and stop.
4. Set N to N + K
5. Set K to K + 1
6. Go back to step 3.
```

10. What is the output of the following algorithm?

```
1. Set A to 1
2. Set B to 1
3. If B > 5 then output B and stop.
4. Output A
5. Set T to A + B
6. Set A to B
7. Set B to T
8. Go back to step 3.
```

11. What is the output of the following Python program?

```
1 fee = 4
2 fo = 2
3 fum = fee + fo
4 print "fee"
5 print fo+1
6 print "fum-1"
```